Net-Sights: A Practical Guide

Network insights for collaborative sustainable production

Andersen, Jakob Wulff; Parraguez Ruiz, Pedro; Maier, Anja

Publication date:
2016

Document Version
Publisher's PDF, also known as Version of record

NET-SIGHTS

NETWORK INSIGHTS FOR COLLABORATIVE SUSTAINABLE PRODUCTION

A PRACTICAL GUIDE

INDUSTRIENS FOND
FREMMER DANSK KONKURRENCEEVNE
The Danish Industry Foundation

DTU

Net-Sights

You can find this guide, the tool, and
the scientific outcome of the project at
www.netsights.dk

CONTENT

“More than ever, partnerships are now expected to continue to support (...) actions in realizing sustainable development. Unlocking the vast knowledge and expertise that these partnerships and partners collaboratively possess, holds the key to effectively supporting the achievement of the Sustainable Development Goals.”

United Nations
Department of Economic and Social Affairs (2016)

ABOUT THIS GUIDE

Current environmental challenges, scarce resources and highly competitive global markets create an increasing demand for greener technologies and more integrated sustainable solutions. All of which calls for collaborative innovation on a new level and stronger collaborative innovation partnerships to engineer the systems that will tackle tomorrow's complex challenges.

Science suggests that barriers for successful collaborations include a lack of overview about opportunities and capabilities, as well as a lack of systematic approaches to explore and search for new knowledge. This makes the process of identifying partners and innovation opportunities time consuming and costly. Moreover, while personal connections and search engines can help you find potential collaboration partners, this is often not enough to make the best decision in a vast landscape of opportunities.

Net-Sights is a systematic and systemic approach to solve these problems. It provides a digital decision-support platform developed to facilitate data-driven exploration of and search for potential collaboration partners. Net-Sights gives you a personalised overview of potential collaboration partners based on geographical location, technological capabilities, as well as previous/shared relations. It uses data, cutting-edge network science, and systems thinking to support and facilitate collaborative innovation and is fed by the invisible networks of relationships and capabilities at the heart of Denmark's cleantech industry base.

Net-Sights targets private companies, industry associations, and innovation consortia. Within the target organisations, Net-Sights is most useful for decision makers in R&D, Design and Manufacturing, and Technology Development, with responsibilities such as business transformation, strategic partnerships and alliance formation, new product- and technology development, and innovation management.

In this guide, we focus on sustainable production and the Danish cleantech industry. Net-Sights started as part of a special call on sustainable production by the Danish Industry Foundation. The approach and software tool developed are also applicable and beneficial for other industry sectors and application areas.

We invite you to join the journey to a more sustainable and collaborative future. In what follows, we introduce you to what the future demands, to the challenges that inspire us, and to Net-Sights. We show real use cases and provide a glimpse into where Net-Sights is supporting you in gaining network insights and in designing future connections.

Jakob Wulff Andersen
Pedro Parraguez
Anja Maier

Rising commodity prices and increasing consumption of the planet's resources has set a new strategic agenda for the global economy. These changes represent new challenges but also new opportunities.

There is effective growth potential for Danish companies to translate knowledge and experience in sustainable production to the development of new business areas. Efficient growth requires collaborative innovation on a new level.

THE DEMANDS OF THE FUTURE

THE DEMANDS OF THE FUTURE

The global need and market opportunity for sustainable solutions

Most people have an intuitive sense of the urgent need for a more sustainable future. The increasing demand for green technology and sustainable solutions represents one of the most promising future business opportunities.

Cleantech innovation in Denmark to keep momentum

Denmark and the Nordic countries have come far in the field of sustainability and have a unique cleantech ecosystem. For instance, the energy and climate policy agendas of the Nordic countries are among the most ambitious in the world (OECD / International Energy Agency, 2016).

Denmark in particular has excellent general innovation inputs and strong cleantech policies, including ambitious green energy provisions until 2020. It has a number of high-impact cleantech start-ups, and a relatively high number of investors, but on the other hand, a stagnant number of environmental patents and a decreasing amount of venture capital compared to prior years. Furthermore, the Global Cleantech Innovation Index shows that Denmark's position fell from first place in 2012 to 5th place in 2014. This change in position is mainly attributed to lacking capabilities in developing emerging technologies (Global Cleantech Innovation Index, 2014). The future demands higher visibility of the long-tail of companies, and an increase in emerging innovations.

Unlocking hidden opportunities through collaborative innovation

Collaborative innovation is needed to find new markets and to develop new products and production processes. Denmark has a rich set of highly specialised small and medium-sized companies whose visibility needs to come to the fore. These often overlooked companies hold potentially crucial solutions at the intersection of interlocking technologies. To capitalise on this potential and to go beyond traditional silo thinking, we require collaborative innovation to reach a new level. Such collaborative innovation covers a wide spectrum of practices, which differ depending on partnership types and business models. We may think of smart procurement based on existing innovations, collaborative projects based on specific innovation needs, collaborations to scale innovations, strategic innovation partnerships and joint ventures for collaborations to co-develop and advance innovations (World Economic Forum, 2015).

Data-driven decision-support to identify potential collaboration partners

Better decision-making support tools are needed to explore industrial collaboration opportunities within an ever increasing amount of data. Even with advanced search tools and approaches currently available, it is hard to find partners that fit the specific needs of your innovation project. This is why we need a more transparent and systematic approach that goes beyond traditional search and allows for interactive exploration.

WILL YOUR ORGANISATION DRIVE THE FUTURE OF SUSTAINABLE DEVELOPMENT AND PRODUCTION?

UN Sustainable Development Goals

Technological progress is key to find solutions to both economic and environmental challenges. To efficiently and effectively drive sustainable development and production we need to go beyond isolated products and services. We need to go into complex integrated solutions, bringing the technological and social expertise of multiple stakeholders together.

CLEAN WATER AND SANITATION
Ensure availability and sustainable management of water and sanitation for all ***(un.org, Goal 6)***

Increasing drought and desertification is already worsening depletion of renewable freshwater supplies. By 2050, it is projected that at least one in four people will be affected by recurring water shortages.

RESPONSIBLE CONSUMPTION & PRODUCTION
Ensure sustainable consumption and production aims at "doing more and better with less", which requires a systemic approach and cooperation among actors operating in the supply chain, from producer to final consumer ***(un.org, Goal 12)***

AFFORDABLE AND CLEAN ENERGY
Ensure access to affordable, reliable, sustainable and modern energy for all ***(un.org, Goal 7)***

Rapid advances in the deployment of carbon capture and storage (CCS) or breakthrough production technologies are needed to reduce industrial emissions.
(OECD / International Energy Agency, 2016)

PROMOTE SUSTAINABLE INDUSTRIALISATION
Build resilient infrastructure and sustainable industrialisation and foster innovation
(un.org,, Goal 9)

THE FRONT-END OF INDUSTRIAL COLLABORATION

Organisations often struggle with:

- Complex problems that demand collaborative approaches to develop systemic solutions. This calls for smarter matchmaking mechanisms.
- The scale of modern industrial ecosystems makes it hard to identify and prioritise whom to build relations with for future potential partnerships, and serendipity is not enough.
- Innovation happening across technology sectors, going beyond traditional silos. This calls for an approach that supports exploration of interlocking technologies.
- Information overload may mean that opportunities are overlooked or misunderstood. Effective decision-making support has to combine data with an interactive, visual, intuitive, and explorative approach.

The risky character of collaborative innovation projects creates a need for better decision-making support when exploring new potential collaborations.

“We are highly dependent on collaboration partners and use a lot of resources on finding them. So I need a more structured yet versatile way to investigate potential partners. Something in between Google Search and proprietary tools.

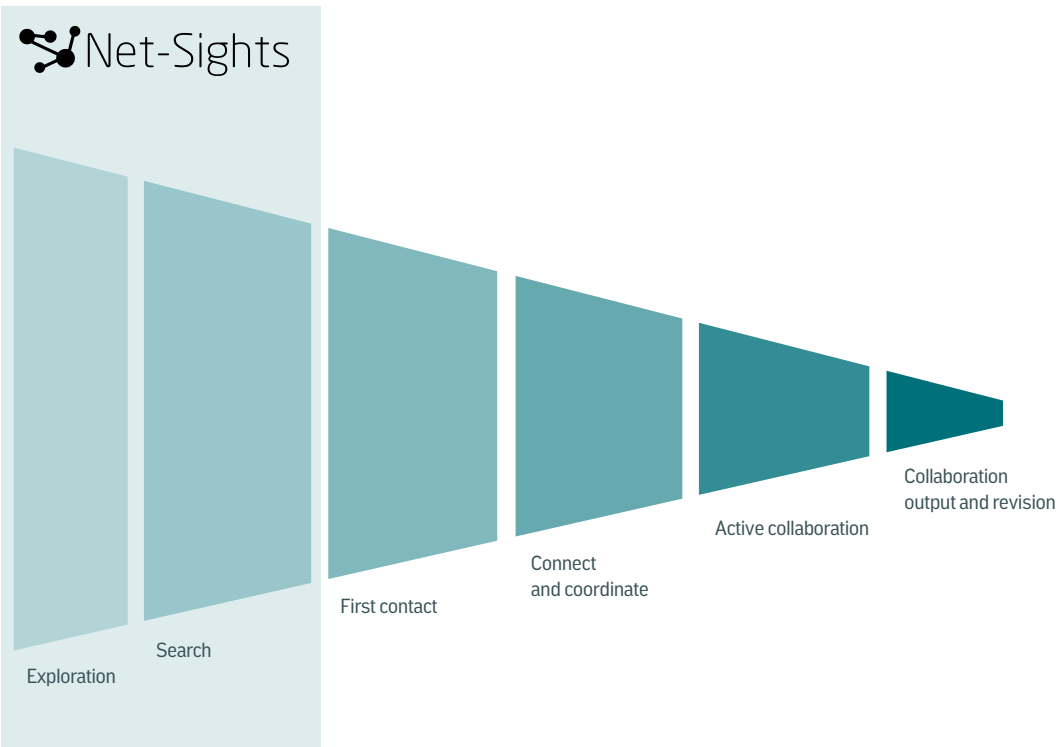
Bo Madsen, CEO of ReMoni

COLLABORATION IS A PROCESS & IT STARTS WITH EXPLORATION

Collaboration is best seen as a process. This process has multiple challenges and countries like Denmark have created a number of innovation networks, industry associations and public agencies to support different stages of the industrial collaboration process. Despite the support already in place, the front-end of industrial collaboration processes remains challenging.

Challenges include a combination of information overload, a lack of systematic approaches and a limited system-level overview. Moreover, any decision made at early stages has profound consequences and may lead to path dependency.

It is thus important to strengthen our capabilities to explore industrial ecosystems before searching for and homing in on specific solutions. We need to move from search to exploration.



“ This tool makes perfect sense for planning our new product development projects more systematically in the future. I like how dynamically the network visualisation responds to the change in parameters.

Frank Hatzack, Head of Innovation, Novozymes


NET-SIGHTS

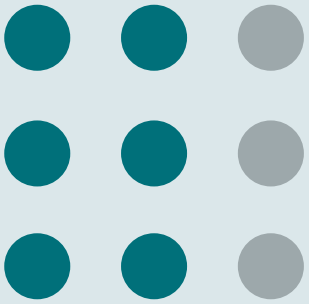
NET-SIGHTS: AN APPROACH AND DECISION-MAKING TOOL

Net-Sights is a data-driven web application that allows you to visually explore and identify collaborative potential between companies. This web application has been developed as an open platform to interactively map and navigate complex industrial landscapes. In its current form, Net-Sights supports decision-making processes in the Danish Cleantech industry, with application cases that range from technological capability mapping at industry-level to matchmaking organisations in the context of specific sustainability challenges.

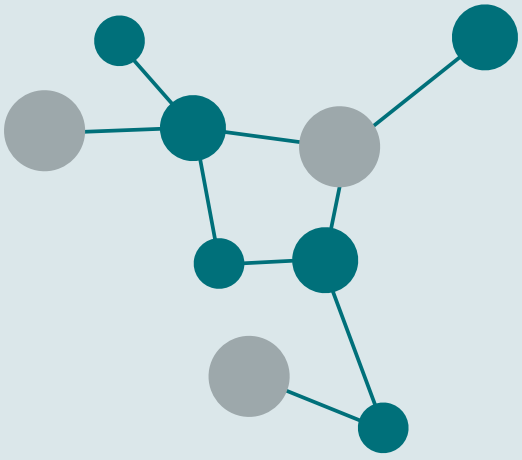
The web application integrates state-of-the-art network science and research on parameters that determine successful collaborations, supporting the front-end of collaboration processes and in particular the stages of exploration and search.

Net-Sights is particularly relevant for organisations seeking more efficient ways of identifying collaboration partners and mapping their complex industrial ecosystems.

From counting ...



...to connecting opportunities



HOW NET-SIGHTS BENEFITS YOUR ORGANISATION

Who Net-Sights is for

Net-Sights works for organisations of all sizes.

Companies

Innovation consortia

Industry associations/ Public agencies

What you can use Net-Sights for

Net-Sights supports your organisation to identify and develop new partnerships in a wide variety of scenarios.

Identify potential new partner organisations

Identify new markets and innovation opportunities

Map industrial capabilities and technology landscapes

Improve matchmaking capabilities

THE SCIENCE BEHIND NET-SIGHTS

Research-based network insights

Three parameters play an important role in collaborative innovation projects: what capabilities an organisation possesses, where an organisation is located, and experience from previous relations.

The parameters influence each other and are also dependent on how innovative the prospect of a potential future collaboration is, how mature the technological capabilities of the partners are, and how strong overall time and budget constraints weigh.

Data-driven

We combine large amounts of data with network science and a responsive visual engine to empower decision-makers without the need to run complicated analyses.

Customisable to your needs

The parameters can be configured in real-time, providing an explorative, interactive and visual interface for partner selection, and exploration of technological capabilities and industrial ecosystems.

PARAMETERS

GEOGRAPHICAL CLOSENESS

Are collaborators close by or far away relevant for the project?

TECHNOLOGICAL CAPABILITIES

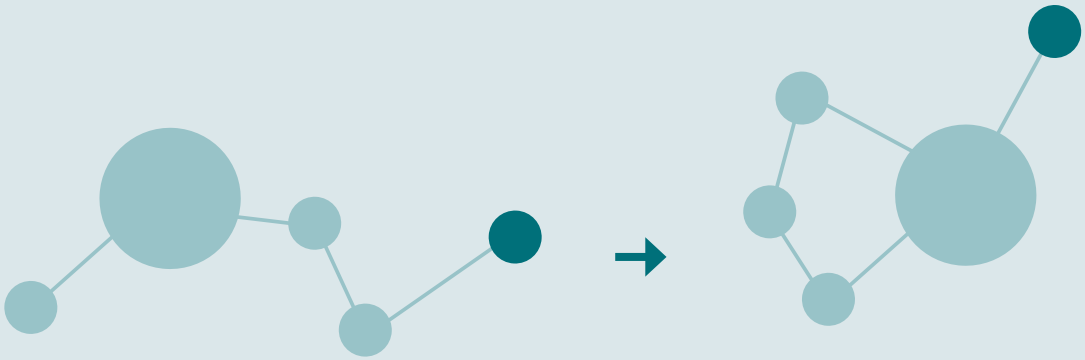
Are you targeting partners with similar or different technological capabilities?

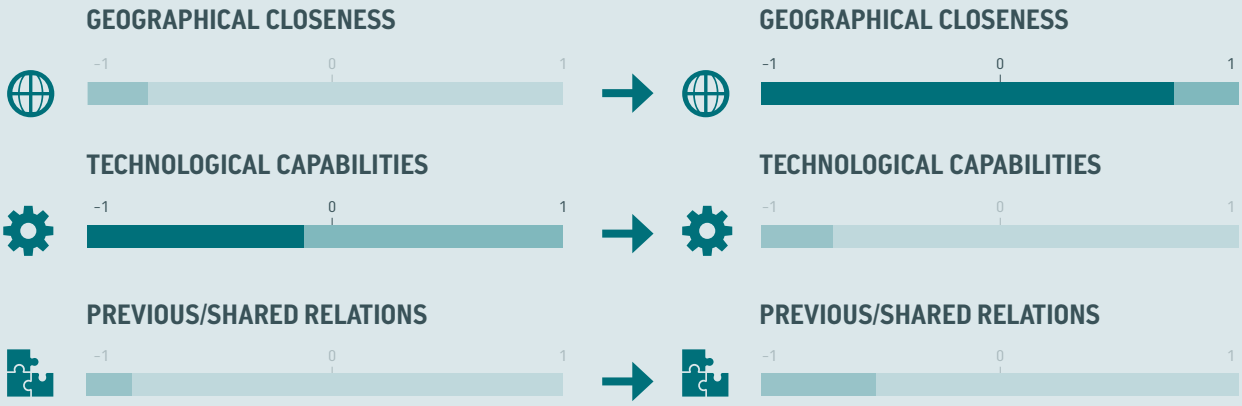
PREVIOUS/SHARED RELATIONS

Should collaborators be within the safe zone of previous relations or originate from new horizons of opportunities?

“The greatest challenge today [...] in all of science, is the accurate and complete description of complex systems.”

Edward Wilson as quoted in Strogatz (2001)





THE FOUR VIEWS FOR NETWORK INSIGHTS

Net-Sights provides four main views:

- Industry overview
- Sector view
- Company-centric view
- Path view

Each view has a particular strength, and in combination they provide a flexible and interactive interface to identify potential partners, explore collaboration opportunities, and to be inspired. In what follows, we briefly introduce each view.

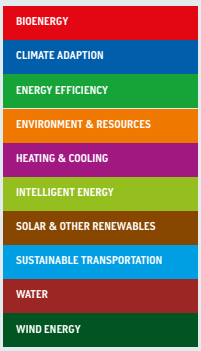
READING THE NETWORK VIEWS

Nodes

Indicate organisations, such as private companies, industry associations, public agencies, innovation consortia.

Links

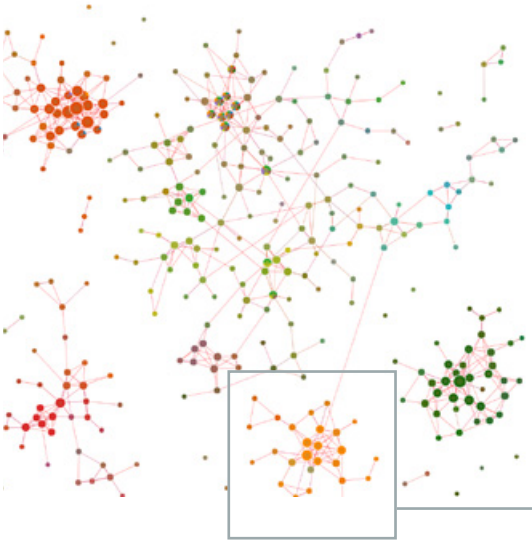
Indicate a relation between organisations. The relation depends on the defined parameters for identifying potential collaboration partners. The shorter the link, the stronger is the relation.



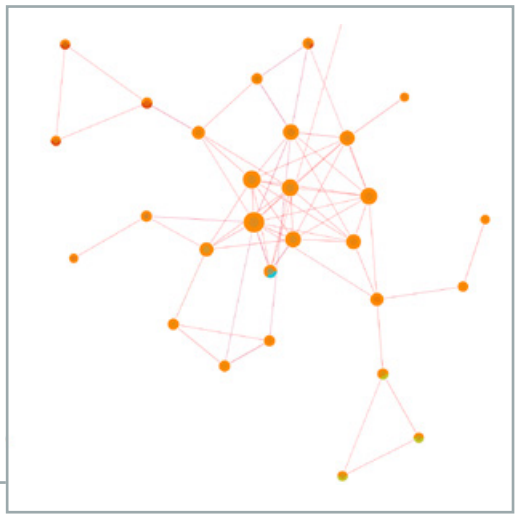
Colours

The colour of the nodes corresponds with industry sectors. Some nodes are multisectorial and thus have multiple colours.

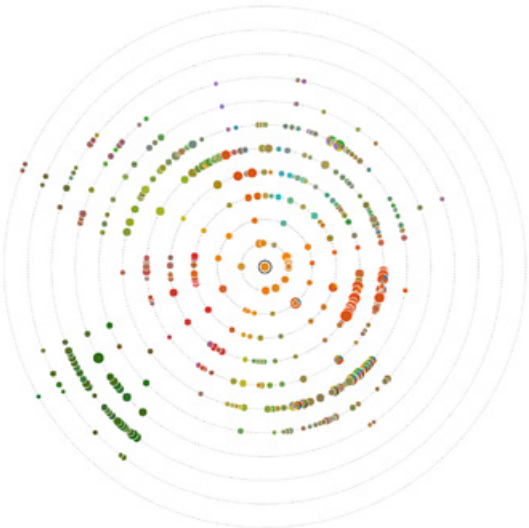
INDUSTRY OVERVIEW



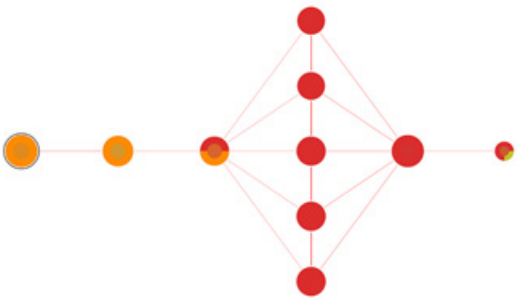
SECTOR VIEW



COMPANY-CENTRIC VIEW



PATH VIEW



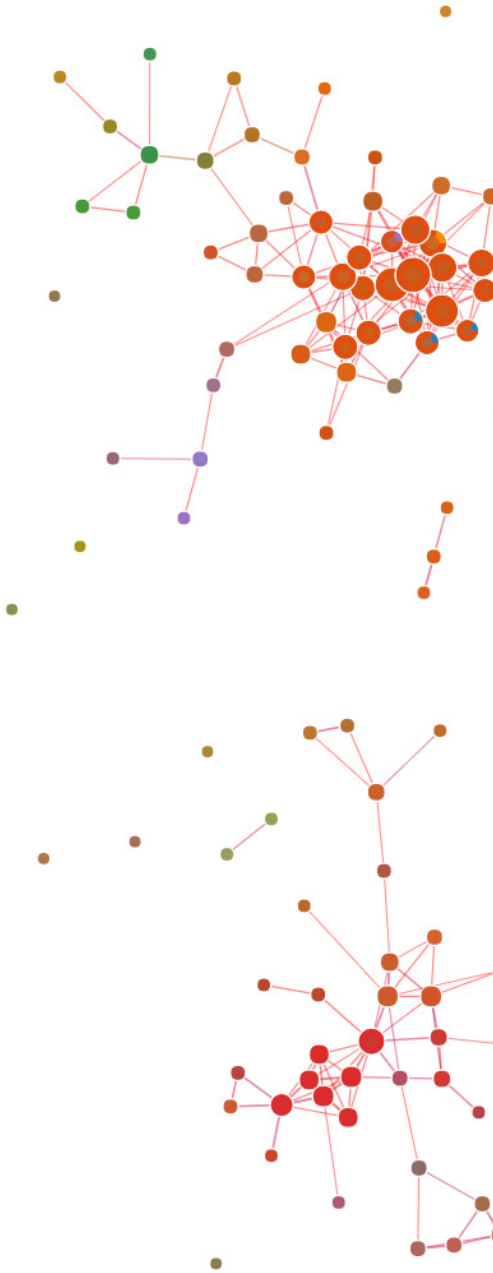
INDUSTRY OVERVIEW

The industry overview shows the underlying structure of interlocking organisations and technologies; in this guide it ranges from a single company to the whole cleantech industry in Denmark. Each node in the network represents an organisation.

A link between two organisations occurs when they share technological capabilities. The connection is stronger if organisations happen to be geographically close or if they have previously collaborated.

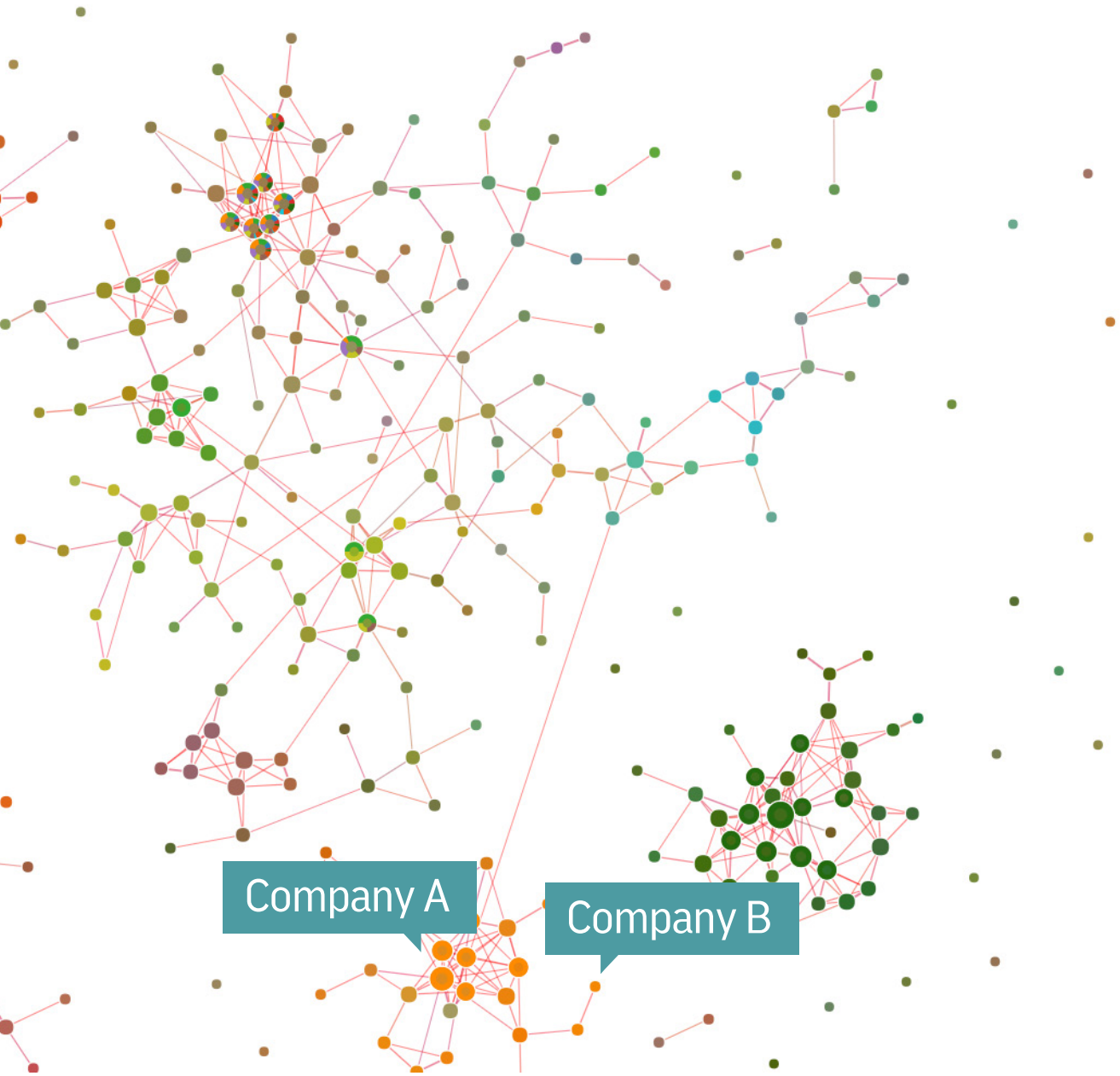
This view allows to spot technology clusters and paths that connect the clusters. Such connections represent opportunities for potential collaborations and bridges that may lead to future innovations.

Primary users of this view are industry associations and innovation consortia as well as companies seeking a better understanding of their position within the overall industrial landscape.



You may use this view to

- improve matchmaking capabilities
- map, explore and navigate the industrial knowledge landscape and ecosystem
- chart the paths for industry and sector development


Company A
Company B

SECTOR VIEW

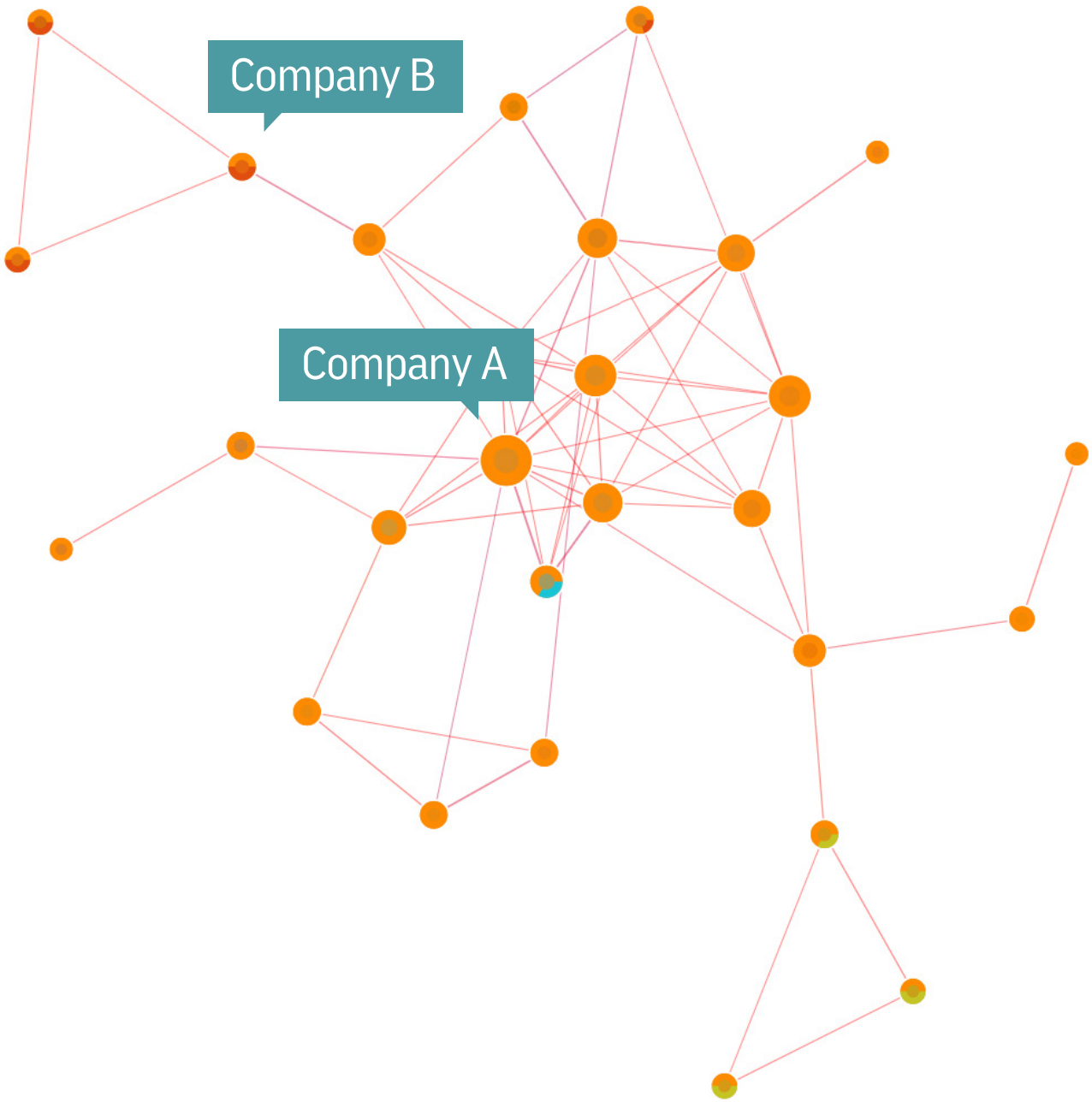
The sector view zooms in on one industry sector to improve our understanding of a particular industrial domain. For example, the cleantech industry includes industry sectors such as heating and cooling, wind, solar and other renewables, etc. Within each sector it is also possible to identify specific sub-sectors; for instance wind energy is divided into electrical components, mechanical components, blade and nacelle technology, and more.

You may use this view to

- identify potential partners for collaborative innovation
- improve matchmaking capabilities
- map, explore and navigate the industrial knowledge landscape and ecosystem
- explore and navigate inter-organisational knowledge

“With this tool it would be possible to use the sector view to map and situate capabilities, products, and solutions from the different business entities.

Ole Skovbæk, Senior Director Product Management & Services, Danfoss


Company B
Company A

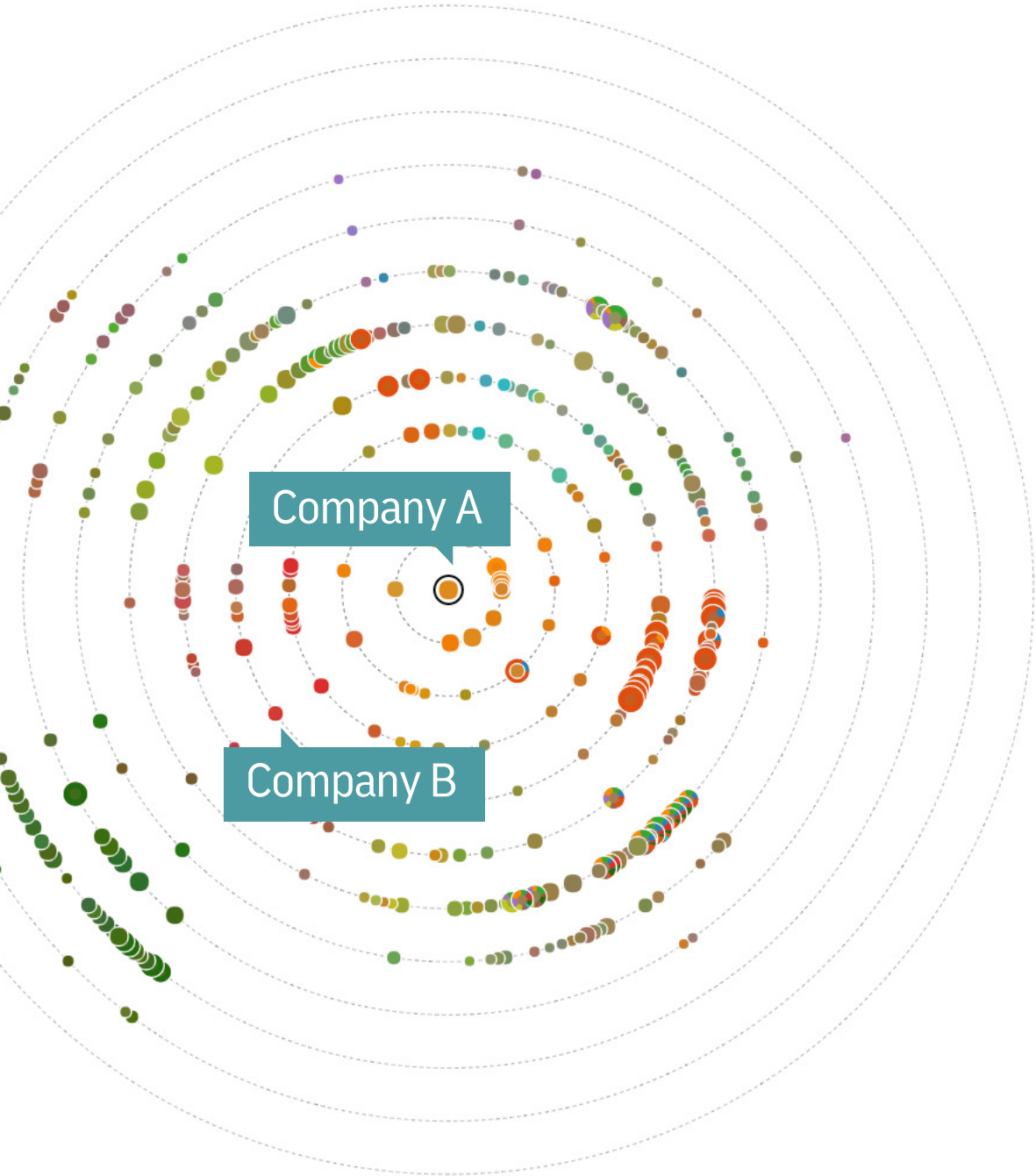
COMPANY-CENTRIC VIEW

The company-centric view places the organisation of interest in the centre of the analysis and visualisation. It provides an overview of the full spectrum of industrial sectors and companies organised along concentric circles based on the selected parameters.

The inner concentric circles show the organisations closest geographically, technologically and/or relationally to the focal organisation.

You may use this view to

- rank and prioritise nearby collaboration opportunities
- group technology capabilities and nearby clusters which are relevant for one particular organisation
- customise for selected organisations and modify according to specific assumptions and needs


Company A
Company B

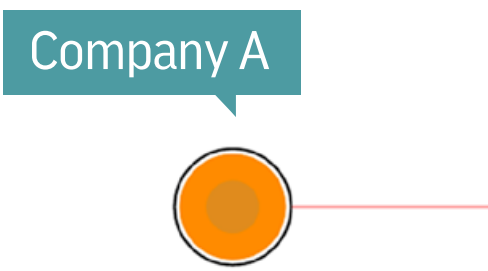
PATH VIEW

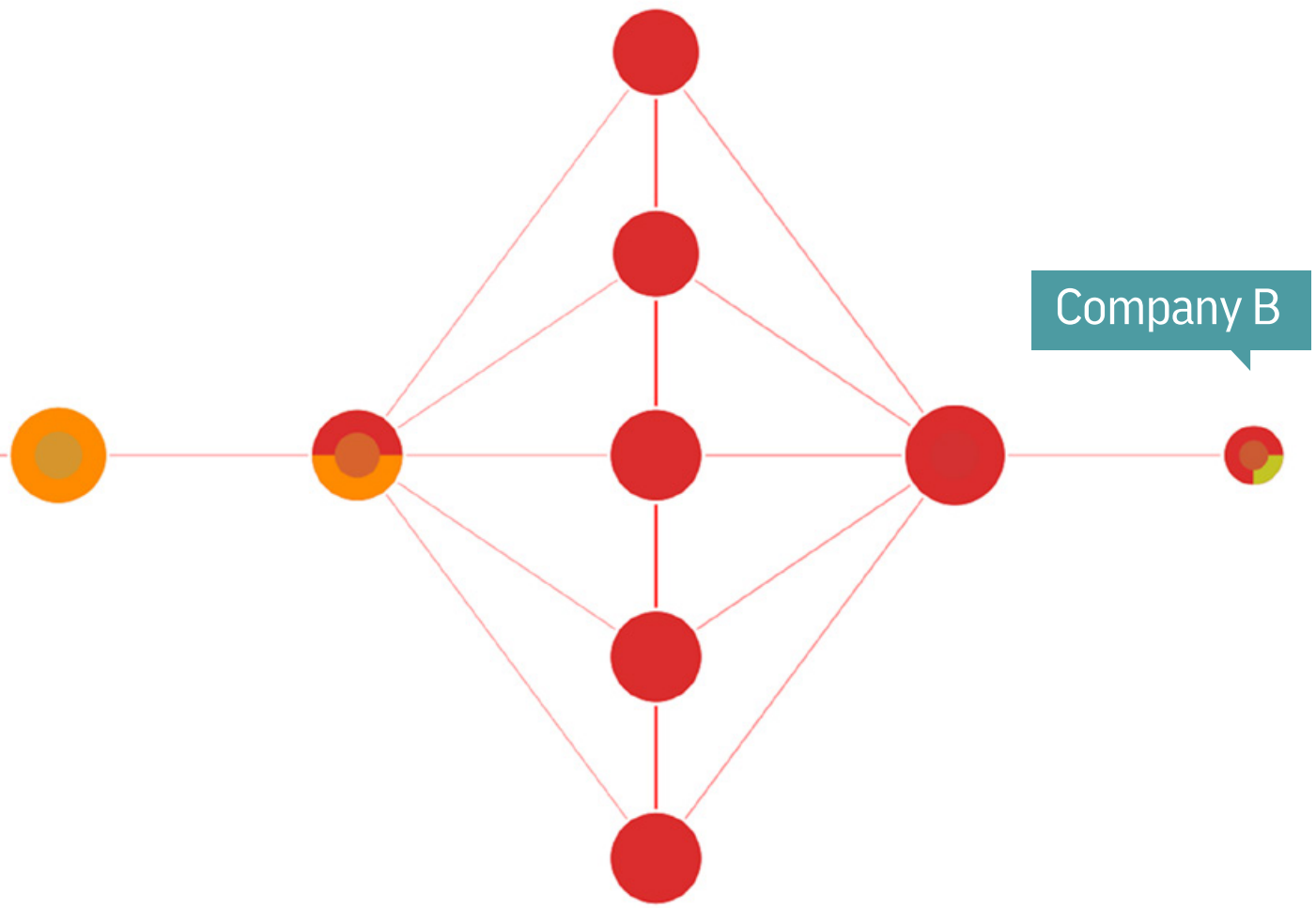
The path view shows potential paths between any two organisations based on the selected parameters.

For example, if company A wants to work with company B, but is not directly connected in the graph, it can use this view to find third parties that appear as complementary to their potential relation given the geographical, technological and/or relational characteristics.

You may use this view to

- get help in the creation of multi-stakeholder collaborations, where it is necessary to find new complementary partners
- evaluate collaboration strategies and alternatives
- improve matchmaking capabilities




Company B

Net-Sights supports decision-making processes for industry associations, innovation consortia, and companies.

On the next pages you will find three concrete use cases that provide ideas about how Net-Sights can be used to bring new insights into specific industrial challenges.

You'll find a comprehensive tutorial for the tool on www.netsights.dk


CASES

STATE OF GREEN & CLEAN

Industry association: Mapping interlocking technologies and organisations in the Danish cleantech industry

Challenge

Industry associations, such as State of Green and CLEAN as well as public agencies, seek to facilitate connections in and for the Danish cleantech industry. These complex tasks require a systemic understanding of the industrial ecosystem and present some of the following challenges:

- Definition and quantification of opportunities for technological development between sectors.
- Orchestration of organisations and consortia to support technological development.
- Inter-organisational matchmaking.

Network insights

Net-Sights allows you to see how the main sectors in the Danish cleantech industry are already connected and the potential way in which technologies may connect together in the future – what we call interlocking technologies. This switches the focus from silo-thinking to industrial ecosystems and capability mapping (as seen on the next pages).

In the centre of this network we find highly connected sectors acting as technology hubs, this includes energy efficiency, intelligent energy, climate adaptation and a number of multisectorial companies and organisations.

Around the centre of the network we have sectors that are technologically specialised, meaning that their capabilities are more unique. Some of these sectors have strong connections among themselves, such as the case of heating and cooling with bioenergy or water with environment and resources. In contrast, some sectors such as wind energy are cohesively connected internally, but have only a few connections with the rest of the cleantech industry. This indicates high levels of maturity and specialisation.

Decision-making impact

Net-Sights has provided data-driven support that:

- Helps organisations such as State of Green re-think technological sectors and their categories. This aids in the crafting of more targeted support strategies that go beyond pre-defined silos.
- Facilitates the matching of foreign industry delegations with Danish companies, allowing organisations like CLEAN to better prioritise their efforts.
- Provides means to identify companies for challenge-driven projects such as CLEAN's VIS project, where we helped to identify new companies with potential to generate innovative solutions in the water sector.

Turn page for an overview

Case organisations
State of Green & CLEAN

Objective
Gain an improved overview of interlocking technologies in the Danish cleantech industry to develop targeted support

Targeted sectors
Overview of all sectors

Parameters
Focus on technology capabilities between organisations

GEOGRAPHICAL CLOSENESS

Location within Denmark was in this case not a priority for mapping interlocking technologies. As such, geographical closeness was assigned a low weight.

TECHNOLOGICAL CAPABILITIES

A dominant parameter to identify relations between technologies are common sectors. Therefore, technological similarity was assigned maximum weight.

PREVIOUS/SHARED RELATIONS

As with location, previous collaborations were in this case not as important as technological closeness for mapping interlocking technologies. Therefore, relational closeness was assigned a low weight.

State of Green
Join the Future. Think Denmark

CLEAN
INNOVATING GREEN SOLUTIONS

STATE OF GREEN & CLEAN

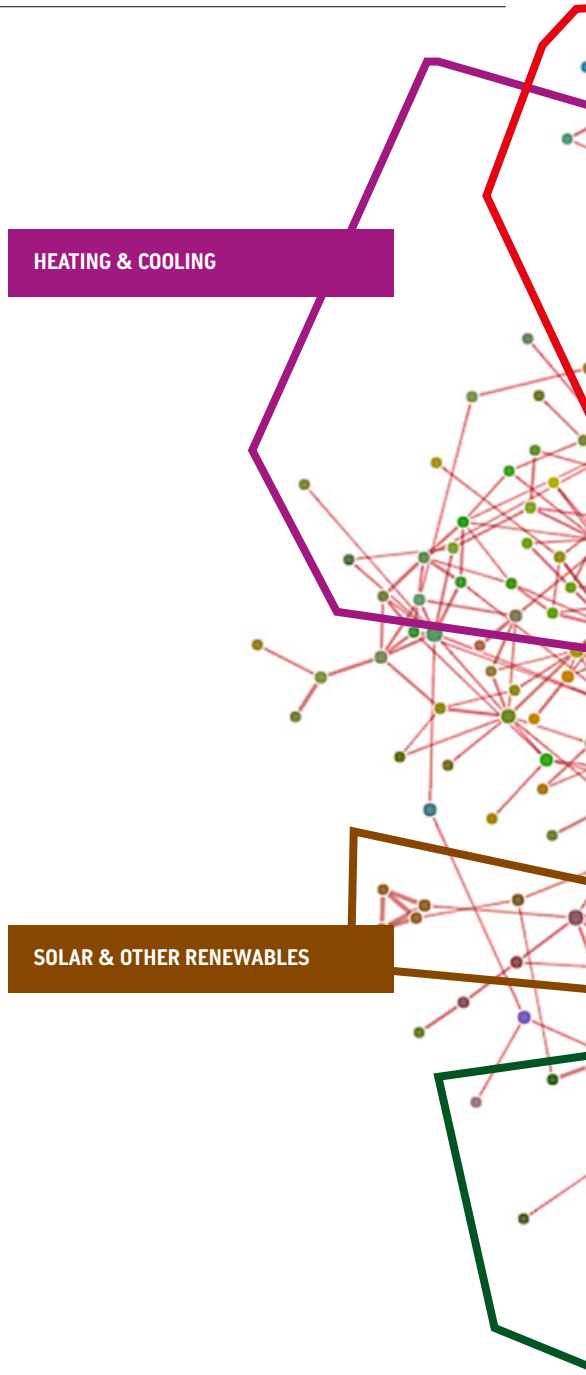
This network maps each organisation of the Danish cleantech industry incorporated in the State of Green database. Connections between organisations are created primarily based on technologicalcloseness. These connections show links between sectors and sub-sectors. This network overview provides a better understanding about interlocking technologies.

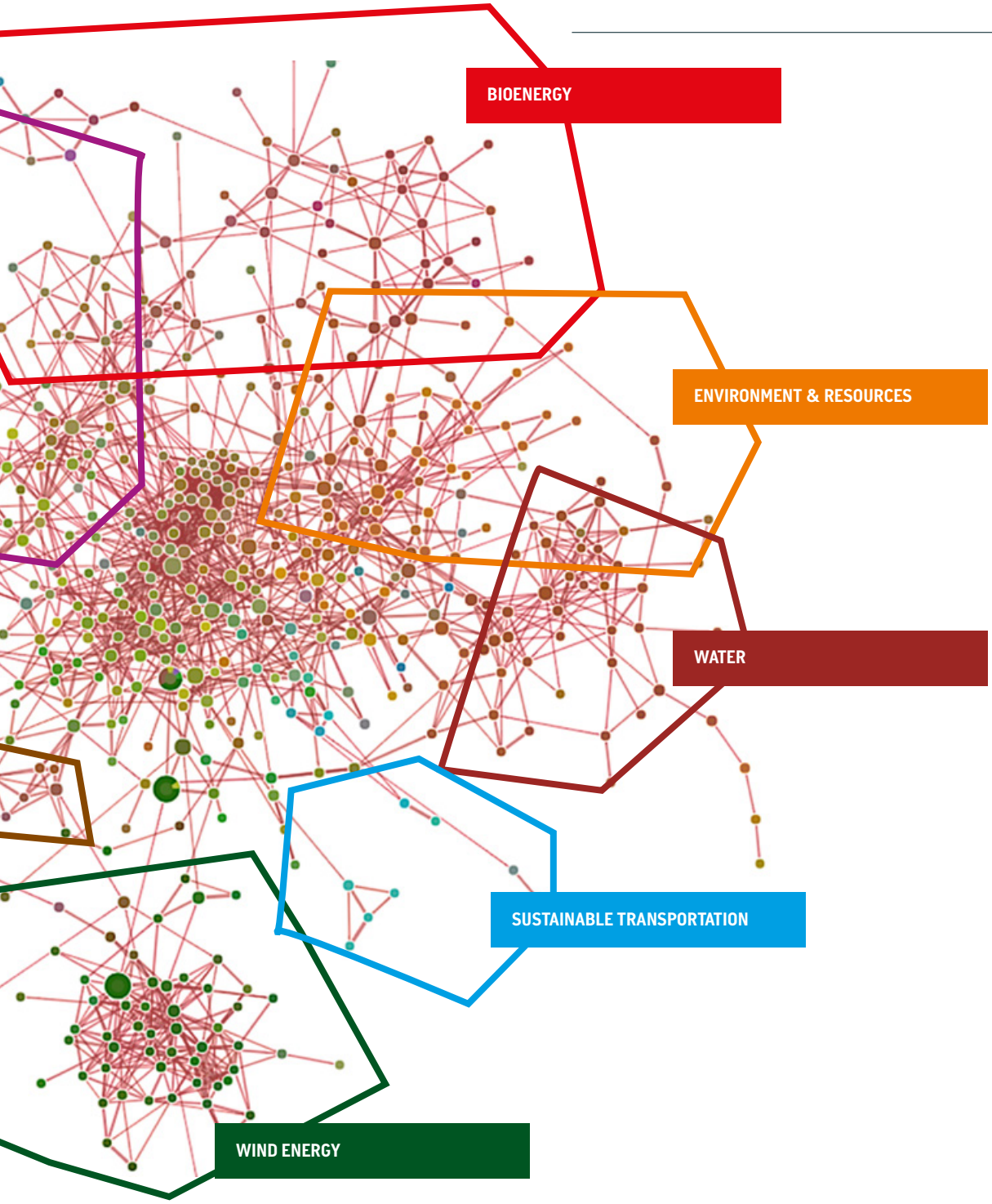
Example

The center of the network shows what can be interpreted as a multi-sectorial hub. The hub is composed of industry associations, governmental agencies and organisations working on technologies relevant for multiple sectors, such as **energy efficiency, intelligent energy and climate adaptation.**

In the periphery of the network we can see mature sectors such as **wind energy** and emergent sectors such as **sustainable transportation**. Such sectors appear more isolated given their higher level of specialisation.

Finally, sectors such as **bioenergy, heating and cooling, environment and resources, and water** appear closely interlocked which shows heir explicit technological similarity.




BIOENERGY
ENVIRONMENT & RESOURCES
WATER
SUSTAINABLE TRANSPORTATION
WIND ENERGY

NISA

Innovation consortium: Identifying organisations and technologies for the development of next generation sustainable aviation biofuels

Challenge

NISA (Nordic Initiative for Sustainable Innovation) is an organisation that proactively pursues innovation and the advancement of sustainable aviation as a long-term business opportunity. At present, there are no viable alternatives to liquid jet fuels. Future sustainable solutions can only be achieved through close cooperation among relevant stakeholders. To achieve this, in turn, technology clusters and innovation consortia play a vital facilitation and coordination role.

Current developments in next-generation biofuels have dramatically expanded the type of relevant capabilities and potential resources for biofuel production including algae, bacteria, wood, agricultural biomass, and waste. This expansion in the space of combinatory possibilities has considerably increased the technological and industrial complexity of developing competitive and sustainable biofuels. Therefore, there is a need for decision-making support. The need for decision-making support also expanded to include:

- Exploring possibilities for co-processing biofuels using existing facilities and capabilities.
- Organising individual technologies and their developers to collaborate around specific production pathways throughout the value chain.

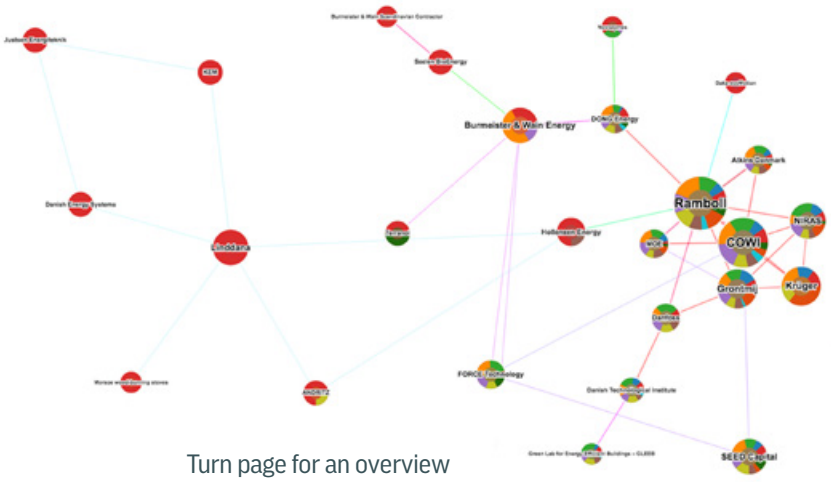
Network insights

In the Nordic countries, the bioenergy sector presents a rich industrial ecosystem with strong connections to heating and cooling, transport, environment and resources, and climate adaptation among other areas. This ecosystem is therefore a fertile ground sector a fertile ground for innovation but also a complex mix of interlocking technologies and supply chains. In order to prioritise and structure potential partnerships, it is key to map technological capabilities alongside the other parameters like geographical closeness and relational conditions.

Decision-making impact

Net-Sights has supported the decision making processes by means of:

- An overview of the diversity and complexity of technological capabilities within the bioenergy sector.
- Identifying groups of companies more likely to establish successful new collaborations.
- Helping to visualise organisations that act as bridges between technology sectors and sub-sectors to facilitate targeted matchmaking and to tackle complex technological challenges.



Turn page for an overview

Case organisation

NISA

Nordic Initiative for Sustainable Aviation

Objective

Mapping capabilities for the development and production of approved sustainable jet fuel

Targeted sector

Bioenergy/Sustainable fuels

Parameters

A combination of geographical closeness and relational conditions within the whole supply chain, e.g. the bioenergy sector

GEOGRAPHICAL CLOSENESS

Geographical location is highly relevant for circular economy and industrial symbiosis projects, yet, not as critical for other circumstances. Therefore, geographical closeness was assigned a medium weight.

TECHNOLOGICAL CAPABILITIES

Exploration here has been restricted to the bioenergy domain and the objective is to find recombinant innovation opportunities. Therefore, technological closeness was assigned a negative weight to prioritise connections between different sectors.

PREVIOUS/SHARED RELATIONS

Previous collaborations are useful for new biofuel projects but not critical. Therefore, relational closeness was assigned a medium weight.

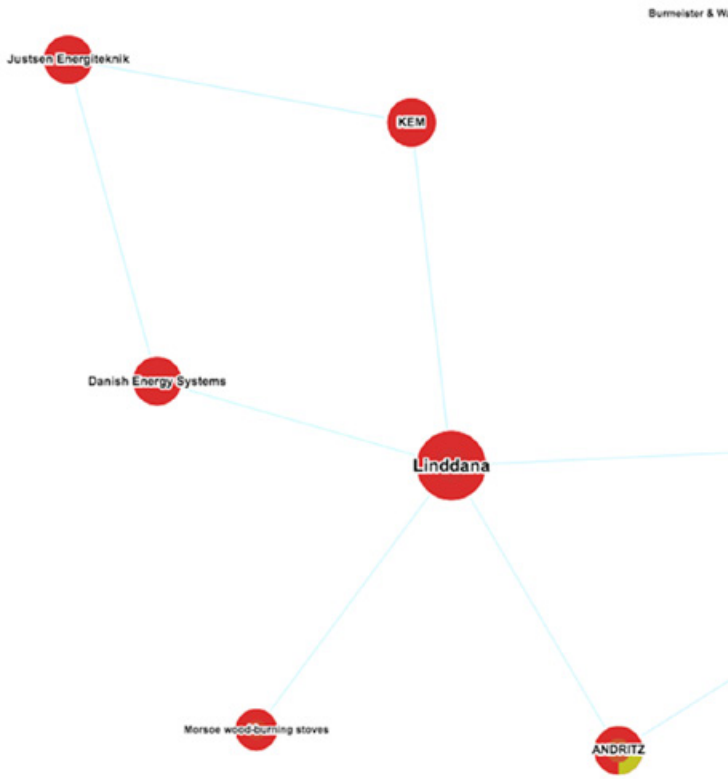
NISA
Nordic Initiative for Sustainable Aviation

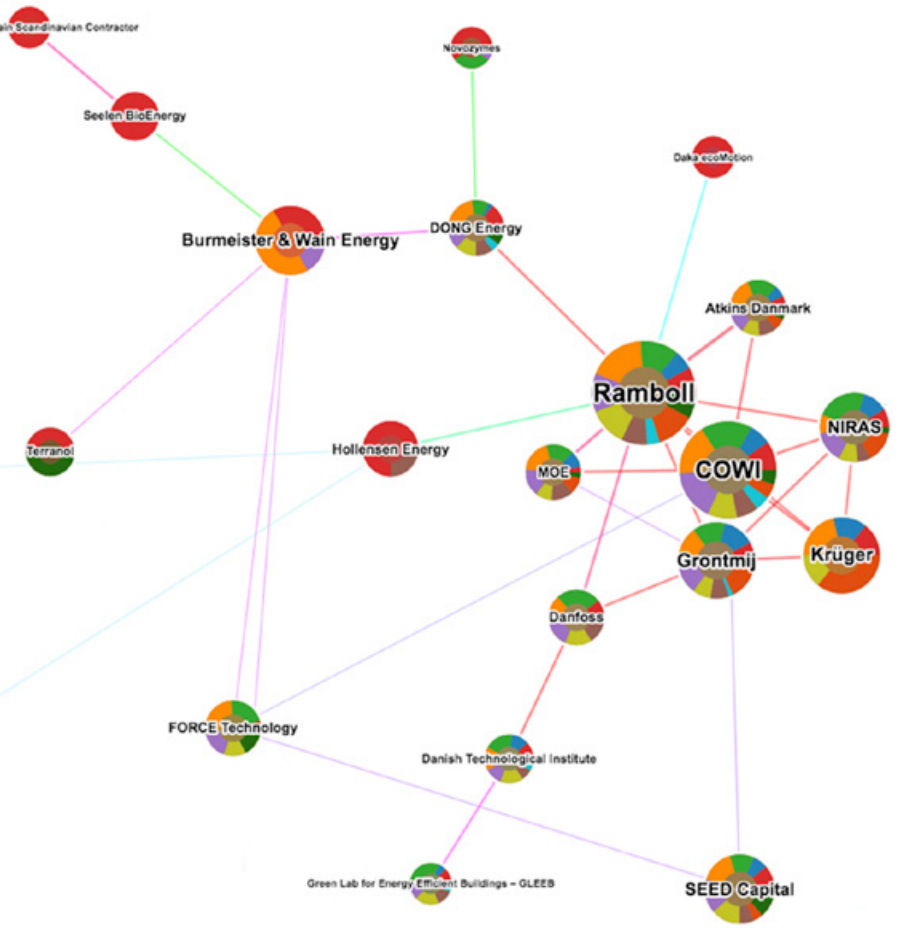
NISA

This network shows cleantech organisations in the bioenergy sector connected primarily based on their geographic and relational closeness.

Here, we can see different types of links between the organisations. In blue previous collaborations, in green the effect of geographical closeness, in red connections based on technological diversity, and in purple instances when links are combined.

This view can be used to identify potential actors at each step of the supply chain and their pre-existent links. For example, we can see here large engineering companies alongside R&D organisations with biofuel capabilities and actors in traditional areas of the bioenergy sectors such as biomass. Large-scale innovative biofuel projects could benefit from integrating this broad set of pre-existing capabilities.





Sectors

- BIOENERGY
- CLIMATE ADAPTION
- ENERGY EFFICIENCY
- ENVIRONMENT & RESOURCES
- HEATING & COOLING
- INTELLIGENT ENERGY
- SOLAR & OTHER RENEWABLES
- SUSTAINABLE TRANSPORTATION
- WATER
- WIND ENERGY

LIQTECH

Company: Exploring partnership and innovation opportunities for a high-tech Danish cleantech company

Challenge

LiqTech is a high-tech Danish SME that develops, manufactures and supplies silicon carbide ceramic technology for the purification of liquids and gases. As LiqTech designs and manufactures in Denmark, they can with agility pursue collaborative new product development opportunities in a wide range of environmental challenges. Whilst they have good knowledge about their direct competitors and traditional customers, given the wide range of potential applications of their filtration technologies, it is hard for them to have a comprehensive picture of all opportunities and cleantech sub-sectors. More specifically, their challenge can be broken down into:

- Exploring new applications for their filtration technologies and thereby unlocking new potential markets.
- Identifying potential new product development partners to further develop their technologies and enhance their sustainable production efforts.

Network insights

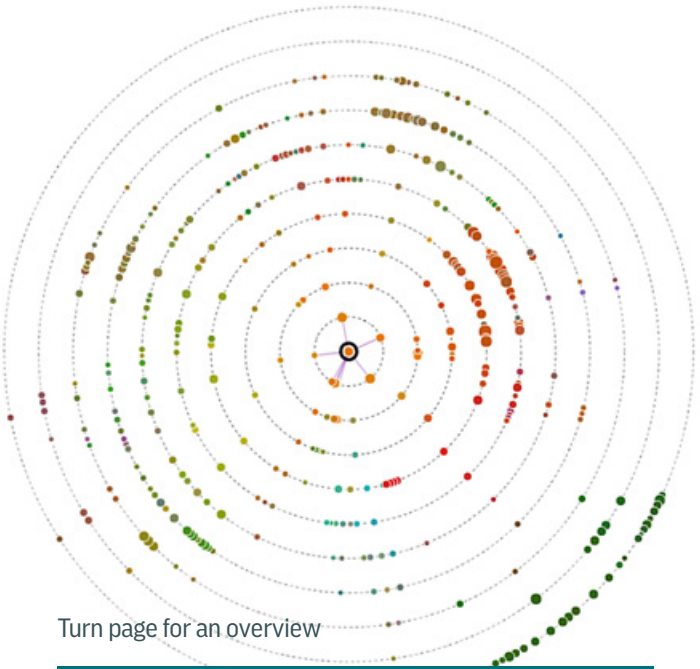
The company-centric view provides LiqTech with a ranked and organised overview of nearby collaboration opportunities and technological sectors. This view allows LiqTech to identify specific organisations which are predicted to be of potential interest for co-development and commercialisation efforts. In terms of opportunities, some insights that emerged from the exploratory analysis include:

- Air, water and soil treatment: Companies working in the bioremediation of soils represent interesting co-development and commercial opportunities for LiqTech. LiqTech's filtration membranes can be used alongside bioremediation to filter waste which is hard to remove, such as heavy metals and other degrade residues.
- Sensors and monitoring: Several organisations in this group are of relevance for LiqTech when it comes to co-developing and commercialising filtration systems.
- Biogas and biomass: Within the bioenergy sector and in particular within biogas and biomass, LiqTech's emission technology can be applied to reduce air pollution, e.g. CO, HC, and NOx.

Decision-making impact

Net-Sights has supported LiqTech's decision-making by means of:

- Identification of new markets for commercialisation and potential new organisations operating in those markets.
- Prioritisation and ranking of opportunities that can be followed up by one-to-one meetings and contacts with industry associations to identify available additional support and funding opportunities.



Turn page for an overview

Case organisation
LiqTech

Objective
Identify potential new partnerships and technology sectors

Targeted sectors
Water, Environment & Resources, and Sustainable Transportation

Parameters
Focus on new partnerships (relational closeness parameter set to negative) and a combination of technological and geographical closeness

GEOGRAPHICAL CLOSENESS

In this exploration for collaborative innovation partnerships, location within Denmark was defined as not important. Therefore, geographical closeness was not weighted.

TECHNOLOGICAL CAPABILITIES

A main objective was to identify partners in complementary and related technologies. Therefore technological closeness was assigned the maximum weight.

PREVIOUS/SHARED RELATIONS

Since the purpose was to identify new partners, relational closeness was assigned a negative weight which allows to prioritise potential new partners.

LiqTech INTERNATIONAL

LIQTECH

Co-development opportunities

Our analysis identified a producer of high-tech coatings for a number of industrial applications, where filtration is yet not one of them. Since a key aspect of the nanotech membranes developed by LiqTech is filtration, this network insight opens potential collaboration opportunities.

ENVIRONMENT & RESOURCES

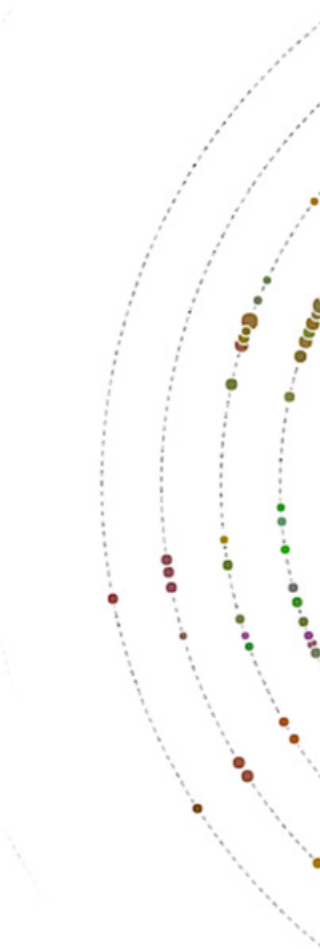
AIR, WATER & SOIL TREATMENT

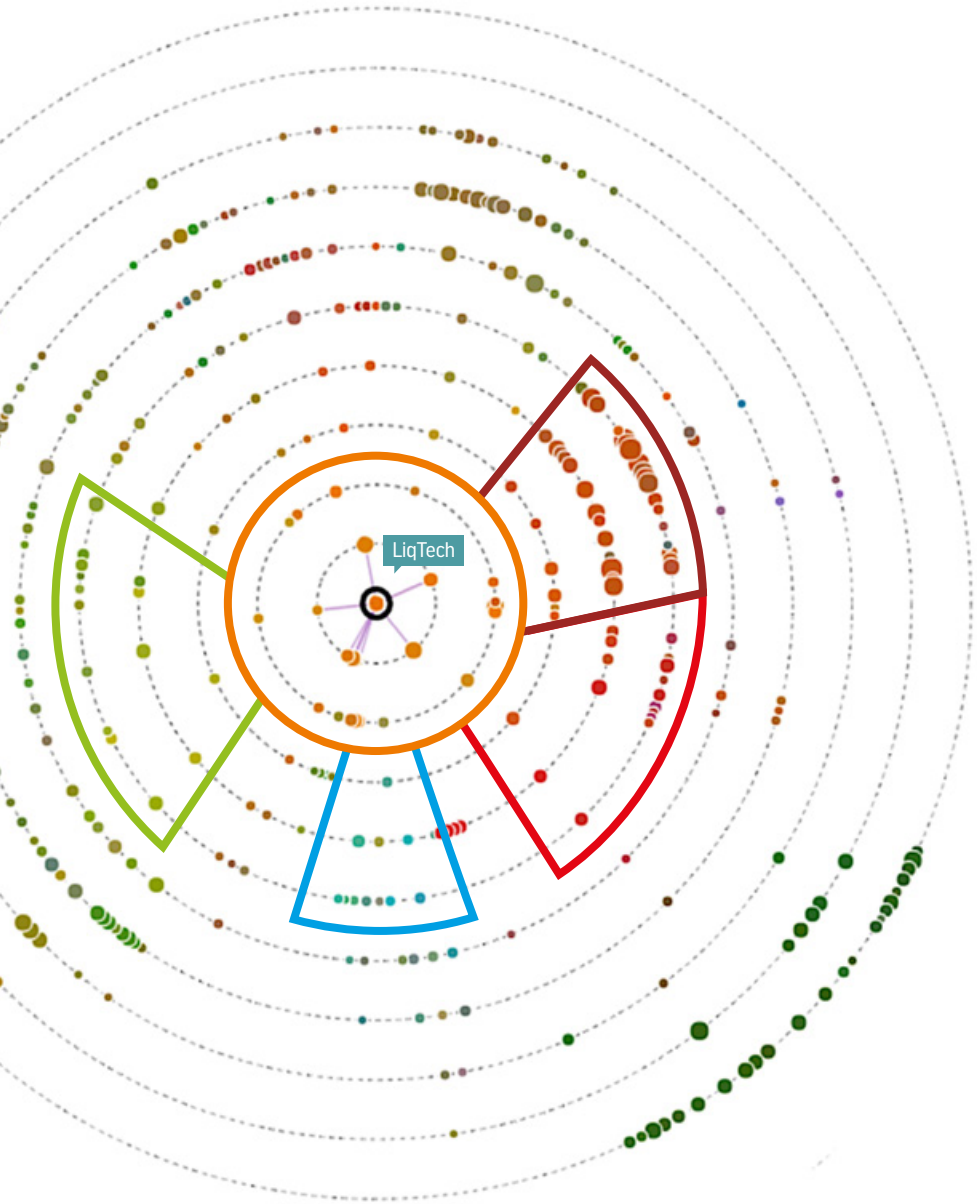
Companies working in bioremediation of soil represent interesting co-development and commercial opportunities for LiqTech. Its filtration membranes can be used alongside bioremediation to filter waste that is hard to remove such as heavy metals and other degrade residues.

INTELLIGENT ENERGY

SENSORS & MONITORING

Several organisations in this group are of relevance for LiqTech when it comes to co-developing and commercialising filtration. systems.





WATER

BIOENERGY

BIOGAS & BIOMASS

Within the bioenergy sector, in particular biogas and biomass, LiqTech's emission technology can be applied to reduce air pollution, in particular CO, HC, and NOx.

SUSTAINABLE TRANSPORTATION

“Only by working together, pooling from our collective strength, and developing new and innovative ways to solve issues, and forge new partnerships, can we overcome the challenges, and opportunities, that we have before us.”

United Nations
Department of Economic and Social Affairs (2016)

OUTLOOK

OUTLOOK

In this guide, we have focused on the application of Net-Sights to support sustainable collaborative production in Denmark.

Net-Sights is developed as a flexible and scalable approach and tool. Future uses and applications include:

- Using the core dataset of cleantech organisations in Denmark to support new challenges.
- Expanding the dataset to include new organisations in other industry sectors and outside Denmark. This opens up new application domains and allows users to be more inclusive both in terms of countries and technologies. New application domains may include the built environment or medtech and healthcare.
- In addition to organisations, other entities such as challenges, technologies, components, patents, people or projects may be represented in the network. Representations support decision-making ranging from the analysis of information and technical dependencies between technologies to capability mapping and intra-organisational management interventions.
- The use of Net-Sights in scientific research, fostering the analysis of large-scale collaborations and complex networks to increase our understanding of industrial ecosystems.

We invite you to get in touch and develop what is next for network insights.

REFERENCES

Parraguez, P., Maier, A.M. (2016).
Network Insights for Partner Selection in Inter-organisational New Product Development Projects. In: Dorian, M., Mario, S., Neven, P., Nenad, B. (Eds.), International Design Conference - Design 2016. Dubrovnik, Croatia, pp. 1095–1104.

United Nations Department of Economic and Social Affairs (2016).
Partnerships for Sustainable Development Goals. www.sustainabledevelopment.un.org

OECD / International Energy Agency (2016).
Nordic Energy Technology Perspectives.

Barabási, L. (2016).
Network science. Cambridge University Press. http://barabasi.com/networksciencebook/

World Economic Forum (2015).
Collaborative Innovation: Transforming Business, Driving Growth. http://www3.weforum.org/docs/WEF_Collaborative_Innovation_report_2015.pdf

Cleantech Group (2014).
The Global Cleantech Innovation Index 2014.

Hidalgo, C., Hausmann, R, et al. (2014).
The Atlas of Economic Complexity: Mapping Paths to Prosperity. The MIT Press.

Fraser, P., Farrukh, C., Gregory, M. (2003).
Managing product development collaborations—a process maturity approach. Proc. Inst. Mech. Eng. Part B J. Eng. Manuf. 217, 1499–1519.

Strogatz, S.H. (2001).
Exploring complex networks. Nature 410, 268–76.

MAIN PROJECT PARTNERS

DTU

The Technical University of Denmark (DTU) is ranked as one of the foremost technical universities in Europe. Net-Sights is conceived and developed by researchers from the Division of Engineering Systems, Department of Management Engineering. We conduct research to understand and improve the design and management of complex systems. Research and training approaches used explicitly focus on cross-fertilisation of the technical-, social-, and human sciences. The Engineering Systems Division has long-standing academic research and student exchanges worldwide and close collaboration with industry in particular from the cleantech, construction, manufacturing, and medtech/healthcare sectors.

INDUSTRIENS FOND FREMMER DANSK KONKURRENCEEVNE
The Danish Industry Foundation

The Danish Industry Foundation (Industriens Fond) is a private philanthropic foundation. It develops and supports innovative, inspirational and economically sustainable projects and initiatives that strengthen the competitiveness of the Danish industry; projects that generate application-oriented knowledge, new competences and innovation, benefiting Danish companies. The Foundation also develops its own strategic initiatives within various areas contributing to an overall strengthening of the industry and business communities in Denmark. Net-Sights is supported by Industriens Fond and was established in the wake of the Foundation's special call for projects dealing with sustainable production.

State of Green
Join the Future. Think Denmark

State of Green is a public-private partnership founded by the Danish Government, the Confederation of Danish Industry, the Danish Energy Association, the Danish Agriculture & Food Council and the Danish Wind Industry Association. Danish companies and organisations are at the forefront of green technology and know-how. State of Green is your gateway to their solutions and to Danish green policies – from green energy to clean water and resource efficiency.

CLEAN
INNOVATING GREEN SOLUTIONS

CLEAN is a world-leading cleantech cluster with an international focus based in Denmark. Its mission is to accelerate the green and sustainable transition while realising growth for the Danish cleantech sector. CLEAN is the one-stop entry to Danish Cleantech, facilitating cooperation among companies in the cleantech market in Denmark and guiding them to new innovative partnerships and business opportunities. The non-profit association is also co-founder of the International Cleantech Network.

PARTICIPATING ORGANISATIONS

- AKJ Inventions ApS
- Attention Design ApS
- BA Systems ApS
- CantoLarsen Consulting
- CLEAN
- Cleantech Scandinavia
- Climawintech ApS
- Climate-KIC
- Copenhagen Center on Energy Efficiency
- Copenhagen School of Marine Engineering and Technology Management
- Danfoss A/S
- Danish Cleantech Hub
- Danish Technological Institute
- DanSolar ApS
- Deloitte A/S
- Dong Energy A/S
- DTU Business
- DTU Compute
- DTU Management Engineering
- DTU Scion
- Econergy PM
- EPG The Netherlands
- Fie Sahl Kreutzfeldt
- Gate Gourmet ApS
- Geokon A/S
- House of Energy
- Industriens Fond
- Innovationsnetværk for Miljøteknologi
- Invest in Denmark:
- Ministry of Foreign Affairs of Denmark
- Johnson Controls Denmark ApS
- KIRT THOMSEN ApS | Visual R&D consultancy
- Krüger A/S
- Lasso X ApS
- LEDpartner ApS
- LiqTech A/S
- MASH Biotech ApS
- Moebio Labs
- NESTA
- Nicodesign
- NNIT / DataScienceHouse A/S
- Nordic Initiative for Sustainable Aviation (NISA)
- NorthQ ApS
- Novo Nordisk A/S
- Novozymes A/S
- OptiTeam ApS
- OxyGuard International A/S
- Re-Match Aps
- ReMoni ApS
- State of Green
- UNEP DTU
- Unfair Fashion
- VIPP A/S
- Wiredelta Denmark ApS

Net-Sights thanks all partners, participating organisations, and the invisible networks of relationships and capabilities at the heart of Denmark's cleantech industry base.


Net-Sights

This guide is the outcome of Net-Sights, a project on network insights for collaborative sustainable production.

The project was carried out at the Technical University of Denmark (DTU) and funded by the Danish Industry Foundation (Industriens Fond).

Research was conducted in collaboration with State of Green and CLEAN, private companies and public organisations from the Danish cleantech industry.

Authors
Jakob Wulff Andersen
Pedro Parraguez / ppru@dtu.dk
Anja Maier / amai@dtu.dk

Technical University of Denmark
DTU Management Engineering
Engineering Systems Division

December 2016

You can find this guide, the tool, and the scientific outcome of the project at www.netsights.dk

ISBN: 978-87-93458-44-4

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